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(71) Applicant: AFG INDUSTRIES, INC. [US/US]; P.O. Box 929, Kingsport, TN 37662 (US).

(72) Inventor: DEANE, Robert, J.; 136 Old Danforth Road, Grafton, Ontario K0K 2G0 (CA).

(74) Agents: TREANOR, Richard, L. et al.; Oblon, Spivak, McClelland, Maier & Neustadt, P.C., Crystal Square Five, 4th floor, 1755 Jefferson Davis Highway, Arlington, VA 22202 (US).

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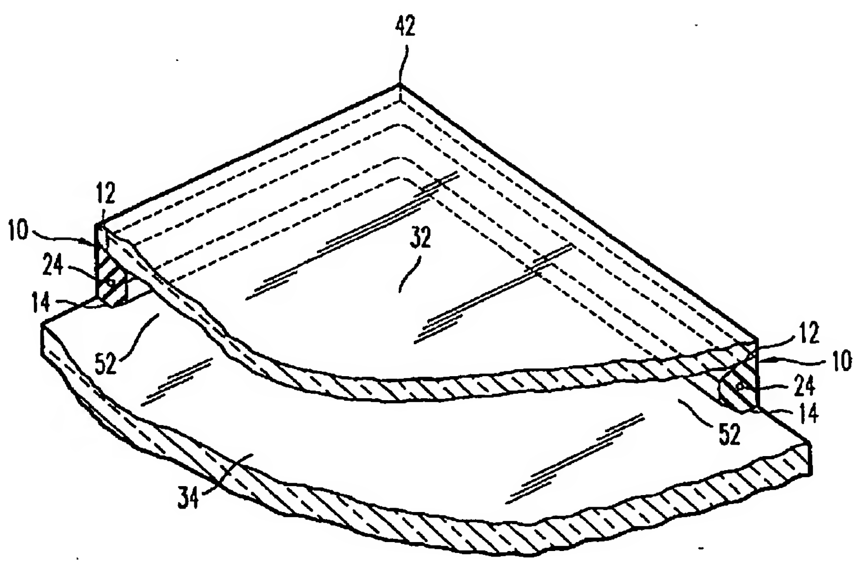
(54) Title: RUBBER CORE SPACER WITH CENTRAL CORD



(57) Abstract

Two glass panes are separated by a so-called core spacer (10) made of either EPDM rubber or another solid rubber material with a centrally positioned fiberglass cord (24) extending longitudinally therethrough for imparting strength to the core spacer (10). The EPDM rubber formulation is chemically compatible with hot melt butyl which is used as an adhesive between the solid rubber and the glass panes. The fiberglass cord (24) is nonstretchable so that the core spacer (10) does not deform or break apart when the core spacer (10) is either initially manufactured or later placed between the two glass panes (32, 34).

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Description

Rubber Core Spacer with Central Cord

This application claims priority from U.S. Provisional Patent Application Serial No. 60/115,953 fifed on January 14, 1999

Technical Field

The invention relates to an insulated glass assembly and, in particular, to core spacers separating glass panes.

Background Art

Insulating glass is usually made of at least two panes adhered together along their edges by a core spacer. In the prior art, there are several types of core spacers manufactured from synthetic foam which is soft and easily compressed. Exemplary is the spacer shown in U.S. Patent No. 5,806,272 which was issued to Lafond on September 15, 1998.

However, such foam core spacers have minimal stability because of their easy compressibility. Furthermore, such foam spacers are readily stretched longitudinally, thus allowing them to be deformed or broken apart before, during or after installation in a window frame.

Another disadvantage of foam core spacers is that they often interact chemically with hot melt butyl, thus causing a stain discoloration which is unacceptable aesthetically. Such a chemical reaction further frequently causes a variety of other problems, like a change in adhesion strength, a shrinkage of the foam spacer, or an expansion thereof. Whenever a shrinkage occurs, the spacer tends to pull away from the corners where the glass panes are joined together. Likewise, if an expansion occurs, the foam spacer becomes misshapen and appears unattractive.

Disclosure of the Invention

A solid EPDM rubber core spacer is provided with a centrally positioned, nonstretchable cord made of fiberglass or similar material for imparting strength thereto.

Furthermore, the EPDM rubber formulation is chemically compatible with hot melt butyl which is used as an adhesive and as a moisture vapor barrier. Although there are many differences between the hot melt butyls manufactured by different companies, it is important to formulate an EPDM rubber which ensures chemical compatibility.

A key advantage of the present invention is improved stability over foam core spacers when in compression during oven pressing, packing, shipping, and installing in windows. In each situation, the solid rubber core spacer undergoes significantly less compression than the foam of the prior art spacers.

Another advantage of the present invention is the incorporation of the fiberglass cord into the rubber core spacer so that no stretching of the spacer occurs during initial manufacture, spacer assembly, coiling of the spacer, and application of the finished spacer between two glass panes. Also, heating and cooling of the spacer does not result in any deformation or breakage of the spacer when in use because of the presence of the continuous nonstretchable fiberglass cord incorporated therein. Of course, in the real world, everything can be stretched to a breaking point if a powerful enough pulling force is exerted. In that sense, the fiberglass cord is nonstretchable under normal conditions of use.

A further advantage of the present invention is that the chemical composition of the EPDM rubber in the core spacer is such that it does not react, other than in a minimally inconsequential way, with hot melt butyl. Thus, this feature of the present invention prevents a chemical reaction that could cause a stain discoloration, a change of adhesion strength, shrinkage, expansion or any other disadvantage inherent in the prior art foam core spacers whenever a chemical reaction takes place.

Brief Description of the Drawings

Fig. 1 is a perspective view of a first embodiment of the present invention.

Fig. 2 is a side elevational view of the first embodiment.

Fig. 3 is an exploded side elevational view of a second embodiment.

Fig. 4a is a side elevational view of a third embodiment.

Fig. 4b is a side elevational view of a fourth embodiment.

Fig. 4c is a side elevational view of a fifth embodiment.

Fig. 4d is a side elevational view of a sixth embodiment.

Fig. 4e is a side elevational view of a seventh embodiment.

Fig. 4f is a side elevational view of an eighth embodiment.

Fig. 4g is a side elevational view of a ninth embodiment.

Fig. 4h is a side elevational view of a tenth embodiment.

Fig. 4i is a side elevational view of an eleventh embodiment.

Fig. 5 is an exploded side elevational view of a twelfth embodiment.

Fig. 6 is a perspective view of the first embodiment.

Mode for Carrying Out the Invention

In Fig. 1, a first embodiment of a rubber core spacer 10, noncircular in shape, is shown with a top side 12, a bottom side 14, a short side 16, a long side 18, and two diagonally cut corners 20 and 22. A centrally positioned fiberglass cord 24 is embedded in the rubber core spacer 10 when the latter is manufactured. The preferred rubber formulation for the spacer 10 is an ethylene propylene diene monomer (EPDM) polymer with fillers. However, other solid rubber materials may be suitable.

The height H varies according to the width selected for the spacer 10. Thus, the height H may range from as little as one quarter to three quarters of an inch or greater.

The cord 24 is cylindrical in shape and has a diameter of at least .01 inch which is sufficient for the cord 24 to be effective inside the spacer 10. However, the preferred diameter is .02 inch.

In Fig. 2, a first hot butyl melt adhesive 26 is applied around the three sides 12, 14, 16 and the corners 20 and 22 of the core spacer 10, although it is sufficient to be applied around only the top side 12 and the bottom side 14. This first adhesive 26 sticks the core spacer 10 between a top glass pane 32 and a bottom glass pane 34. After the first adhesive 26 is positioned, a desiccant 38 is arranged adjacent to the core spacer 10 and is spaced between the panes 32 and 34 by a second hot butyl melt adhesive 28 which is applied around at least two sides and preferably three sides of the desiccant 38 to hold the desiccant 38 between the panes 32 and 34. This desiccant 38 is a drying agent intended to absorb any moisture between the panes 32 and 34 and is open on one side 40 to the space separating the panes 32

and 34. Desiccants are well known in the prior art and many types may be suitable.

In Fig. 3, a second embodiment is shown in an exploded view in which the desiccant 38 has cut corners 46 and 48 to help the second adhesive 28 hold a vapor barrier 30 in place between the core spacer 10 and the desiccant 38. The vapor barrier 30 may be a metallized plastic film embedded at both ends in the second adhesive 28. The core spacer 10 remains in the same position, surrounded on all sides, except for the long side 18, by the first adhesive 26. The two panes 32 and 34, as in the first embodiment seen in Figs. 1 and 2, are held apart by the core spacer 10 while the desiccant 38 absorbs any moisture in the space therebetween.

In Fig. 4a, a third embodiment is shown in which the spacer 10 has its corners 20a and 22a cut longer than the corners 20 and 22 seen in the first embodiment of Figs. 1 and 2.

In Fig. 4b, a fourth embodiment is shown in which corners 20b and 22b of the spacer 10 come to a point 16b instead of to the side 16, as seen in the first embodiment of Figs. 1-2.

Figs. 4c through 4g show further embodiments in which patterns are cut into the top side 12 and the bottom side 14 of the spacer 10 to form voids for a purpose to be described.

In Fig. 4c, a fifth embodiment is shown in which the spacer 10 has triangular indentations 12c and 14c in the top side 12 and the bottom side 14, respectively.

In Fig. 4d, a sixth embodiment is shown in which the spacer 10 has a plurality of serrated teeth 12d and 14d in the top side 12 and the bottom side 14, respectively.

In Fig. 4e, a seventh embodiment is shown in which the spacer 10 has scalloped recesses 12e and 14e in the top side 12 and the bottom side 14, respectively.

In Fig. 4f, an eighth embodiment is shown in which the spacer 10 has deep grooves 12f and 14f in the top side 12 and the bottom side 14, respectively.

In Fig. 4g, a ninth embodiment is shown in which the spacer 10 has a plurality of shallow channels 12g and 14g in the top side 12 and the bottom side 14, respectively.

In Fig. 4h, a tenth embodiment is shown in which the spacer 10 has wide depressions 12h and 14h in the top side 12 and the bottom side 14, respectively. However, unlike the embodiments shown in Figs. 4a through 4g, the spacer 10 in Fig. 4h does not have any cut diagonal corners.

The purpose of the indentations 12c and 14c in Fig. 4c, the teeth 12d and 14d in Fig. 4d, the recesses 12e and 14e in Fig. 4e, the grooves 12f and 14f in Fig. 4f, the channels 12g

and 14g in Fig. 4g, and the depressions 12h and 14h in Fig. 4h, is to allow the first adhesive 26 illustrated in Figs. 1-3 to fill the voids therein so that the adhesive 26 sticks better to the spacer 10 and to the glass panes 32 and 34 of Figs. 1-3.

In Fig. 4i, an eleventh embodiment is shown in which the spacer 10 has a rectangular cross section through which the cord 24 is centrally positioned. Note that there are no diagonally cut corners and no indentations.

In Fig. 5, a twelfth embodiment is shown in which a third hot melt butyl adhesive 50 is used between the first adhesive 26 and the vapor barrier 30 to orient the vapor barrier 30 at both ends perpendicular to the glass panes 32 and 34. The amount of the second adhesive 28 used is less than the amount used in the second embodiment of Fig. 3. The third adhesive 50 may be uncured silicone or urethane.

Also, instead of the diagonally cut corners 46 and 48 of Fig. 3, the twelfth embodiment in Fig. 5 has smaller square cut corners 46a and 48a so that the desiccant 38 is left with a top surface 54 and a bottom surface 56 which provide additional frictional engagement with the top glass pane 32 and the bottom glass pane 34, respectively. In this twelfth embodiment, the six-sided spacer 10 is the same size as the spacer 10 shown in the first and second embodiments of Figs. 1-3.

When heat is applied to cure the third adhesive 50, the entire assembly of Fig. 5 has more structural integrity because the cured third adhesive 50 attaches itself firmly to the second adhesive 26, the metallized vapor barrier 30, and both glass panes 32 and 34.

In Fig. 6, the first embodiment of Figs. 1 and 2 is shown in place, without the second adhesive 28 and the desiccant 38, for ease of illustration. The spacer 10 is adhered at its top side 12 to the top glass pane 32 and also is adhered at its bottom side 14 to the bottom glass pane 34. The pair of glass panes 32 and 34 are parallel to each other but are separated by an interior space 52 to form an entire insulated glass assembly. The spacer 10 extends around the entire periphery between the panes 32 and 34 in an airtight manner. At a 90° corner 42, either the spacer 10 is flexed, thus causing some curvature in the corner 42, or the spacer 10 is cut, thus allowing a sharp 90° corner 42 to be formed. In the latter case, an exterior corner void is back-filled with the adhesive 26, as shown in the embodiments of Figs. 2, 3 and 5. Note that it is necessary to cut only the spacer 10 and not any other materials, such as the second

adhesive 28 and the desiccant 38 in Fig. 2 or the same two materials and the vapor barrier 30 in Fig. 3, or the three last listed materials and the adhesive 50 in Fig. 5. Consequently, the nonstretchable fiberglass cord 24 running therethrough allows the spacer 10 to maintain its structural integrity. Thus, the entire insulated glass assembly is kept intact so that no moisture enters the interior space 52 between the panes 32 and 34.

The above-described embodiments are not limiting, but can be modified in various ways within the scope and spirit of the present invention.

Claims:

1. An insulated assembly having an interior space, composing:

a pair of parallel panes separated by the interior space; and

a core spacer with a centrally positioned, nonstretchable cord embedded therein to maintain structural integrity of the spacer;

wherein the spacer and the cord extend around a periphery and go around corners between the panes in an airtight manner to form the insulated assembly.

2. An insulated assembly, according to Claim 1, wherein:

said core spacer has a height between one quarter and three quarters of an inch and said cord has a diameter of at least .01 inch.

3. An insulated assembly according to Claim 1, wherein:

said parallel panes are flat sheets;

said core spacer is noncircular in shape; and

said cord is cylindrical in shape.

4. An insulated assembly, according to Claim 3, wherein:

said flat sheets are made of glass;

said core spacer is made of rubber; and

said cord is made of fiberglass.

5. An insulated assembly, according to Claim 1, further comprising:

a first adhesive applied around at least two sides of the core spacer for sticking the core spacer between the pair of parallel panes.

6. An insulated assembly, according to Claim 5, further comprising:

a desiccant arranged adjacent to the core spacer and spaced between the pair of parallel panes; and

a second adhesive applied around at least two sides of the desiccant to hold the desiccant between the pair of parallel panes.

7. An insulated assembly, according to Claim 6, further comprising:

a vapor barrier held in place between the core spacer and the desiccant.

8. An insulated assembly, according to Claim 7, further comprising:

a third adhesive applied between the first adhesive and the vapor barrier to orient the vapor barrier at both ends perpendicular to the pair of parallel panes.

9. An insulated assembly, according to Claim 1, wherein:

said core spacer is six-sided in shape with a top side, a bottom side, two other sides, and at least two cut corners.

10. An insulated assembly, according to Claim 9, wherein:

said top side and said bottom side of the core spacer have a pattern cut therein to form voids.

11. An insulated assembly, according to Claim 10, wherein:

said pattern is a plurality of shallow channels.

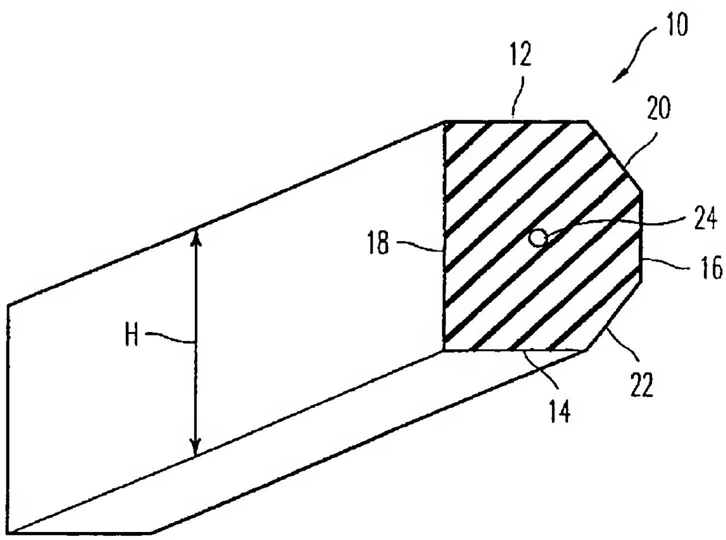

FIG. 1

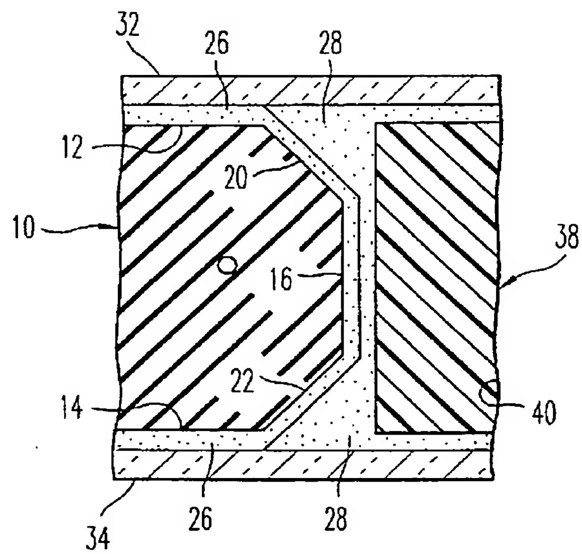

FIG. 2

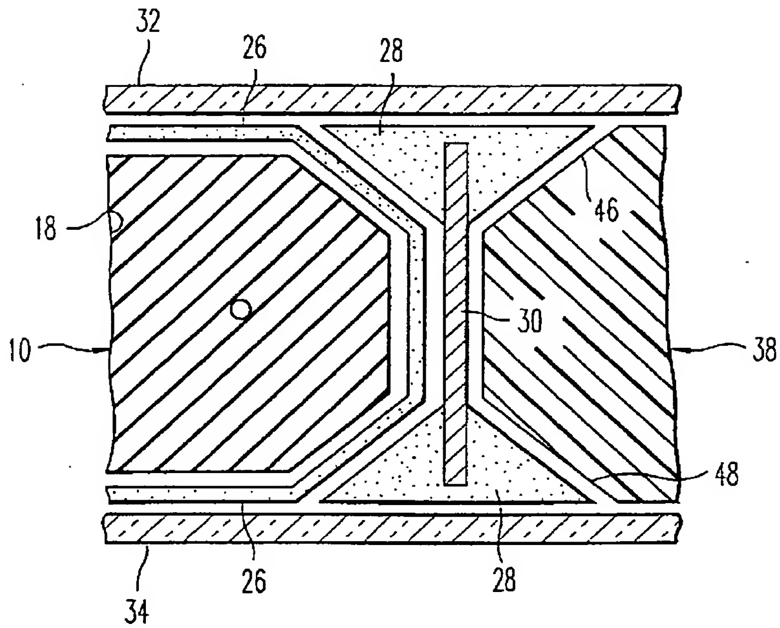

FIG. 3

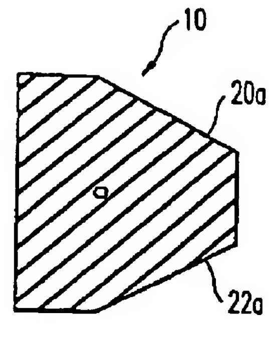

FIG. 4a

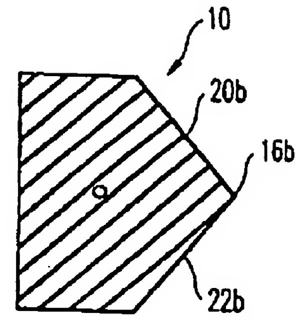

FIG. 4b

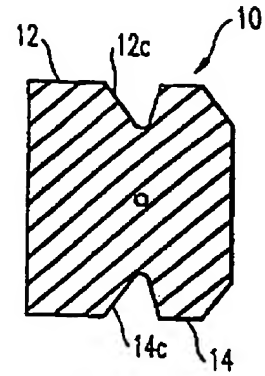

FIG. 4c

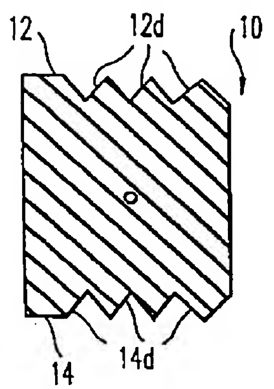

FIG. 4d

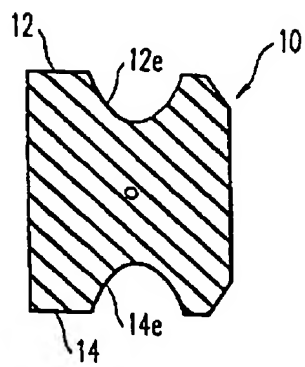

FIG. 4e

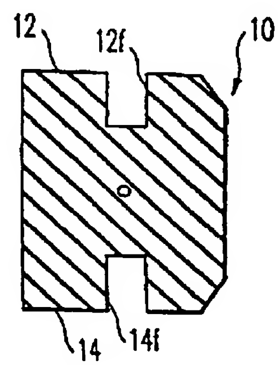

FIG. 4f

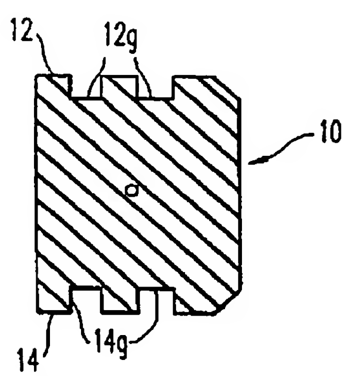

FIG. 4g

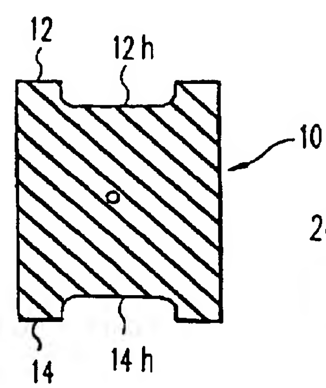

FIG. 4h

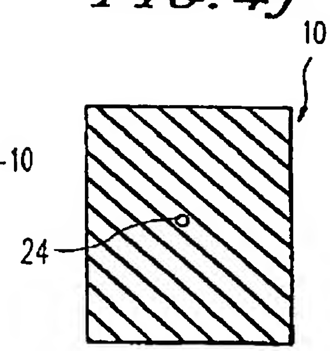

FIG. 4i

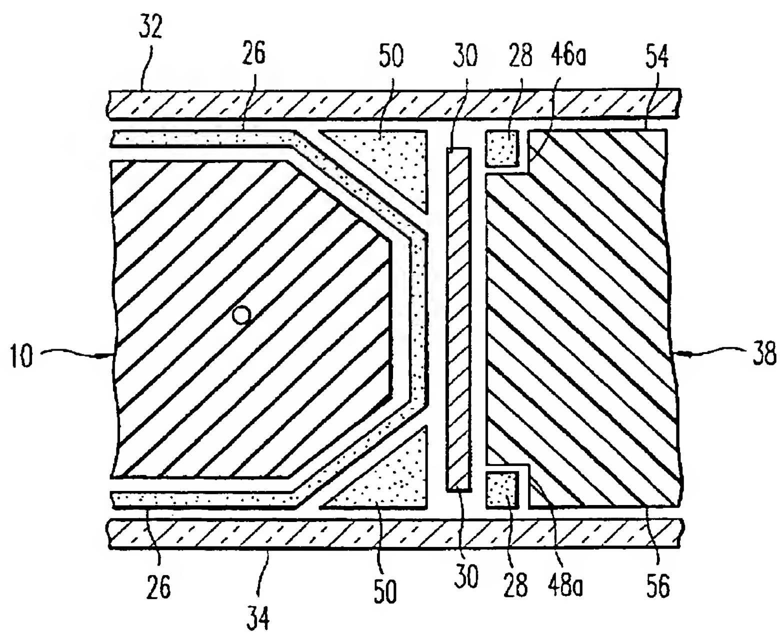

FIG. 5

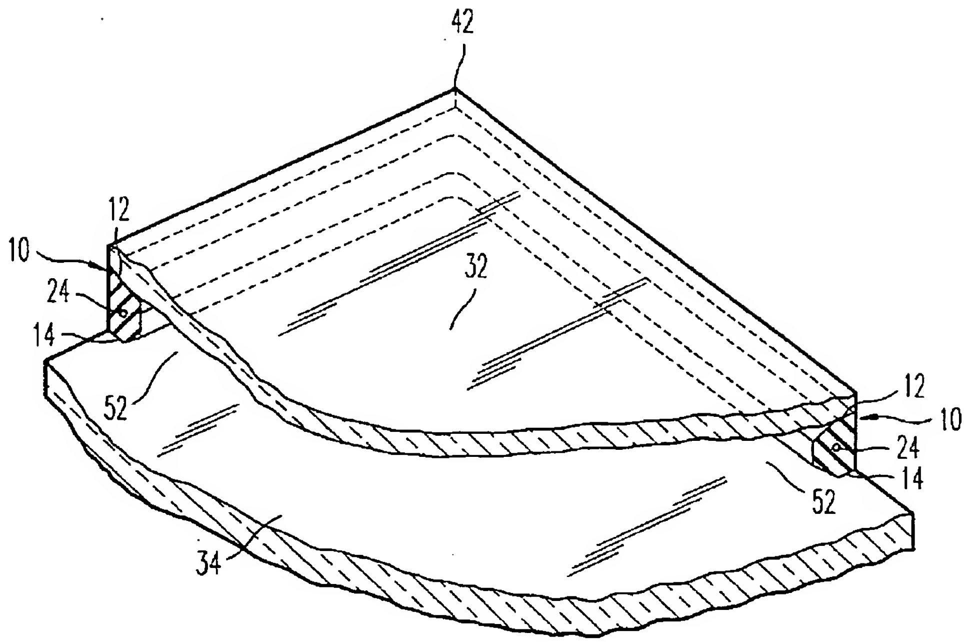

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/00019

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :E04C 2/54; E06B 7/12
US CL :52/786.13, 172; 428/34, 192
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 52/786.13, 172, 783.1, 783.18, 784.15, 784.16, 786.1, 788.1, 790.1; 428/34, 192

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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EAST word search

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,806,272 A (LAFOND) 15 September 1998 (09/15/98), see entire document.	1-11
A	US 5,466,534 A (NEWBY) 14 November 1995 (11/14/95), see entire document.	1-11
A	US 4,658,553 A (SHINAGAWA) 21 April 1987 (04/21/87), see Figures 1-9.	1-11
A	US 5,260,112 A (GRETHER, DECEASED ET AL.) 09 November 1993 (11/09/93), see Figure 1.	1-11

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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